This study argues that as automated information systems in local governments are more oriented to providing top management with information, top managers gain control vis-à-vis lower level managers and staff, clients, and lay policy officials. A measure of "management oriented computing" is developed which indicates the degree computing is oriented to serving top management. This index is related to both the hypothesized payoffs and the hypothesized preconditons of computing being oriented to serve the interests of top management. Survey response data from most of the larger U.S. cities and counties tend to support the power shift hypothesis and identify certain local government milieus most conducive to management-oriented computing. These milieus tend to be characterized by administrative reform values and top management control of computing decisions.

TECHNOLOGY AND URBAN MANAGEMENT The Power Payoffs of Computing

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The rising service demands and fiscal problems of the 1960s and 1970s induced many American local governments to look toward "public technologies" as a means for increasing their productivity (Roessner, 1976). And with the widespread diffusion of new technologies in the public sector has come an increasing concern with two issues involving the politics of technology (Winner, 1977a). One issue involves the organi-

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zational impacts of technology. Who will the technology serve? Another issue involves control over technology. Is the orientation and use of the technology controlled by a technical elite or do its nontechnical users shape its development? The organizational impacts of technology are of special relevance to an analysis of computing in American local government because of the widespread diffusion of computer technology and the broad impacts often attributed to computing. And, control of technology is particularly relevant to computing, given the complexity of computers and electronic data processing which increases the likelihood of control by a technical elite.

The potential impacts of computing in organizations range from the efficiency of operational performance to the power relations among organizational actors. Downs (1967) has persuasively argued that the "power payoffs" of computer-based urban information systems may be extensive. He suggests that computing raises two basic issues which parallel the above issues concerning the politics of technology. These issues are: What groups gain power with the use of computing? And, what groups control computing (for they are likely to gain in power)?

This study contributes to an evolving body of empirical research on these issues concerning computing and the power relations among organizational actors. We focus on the relationship between the introduction of computing in American local governments and how the technology is used by top management. We ask whether computer technology results in power payoffs to top management, and if so, under what conditions do these shifts occur?

THEORETICAL EXPECTATIONS

The potential for power shifts resulting from the use of computer-based information systems stems from the role that information resources play as a basis of power in organiza-

tions.[1] To the degree that computers modify who within an organization has access to what information, some shifts in power are expected to occur (Downs, 1967; Whisler, 1970b). Specifically, we expect that, as automated information systems are more oriented to providing top management with information, top managers in organizations gain greater control vis-à-vis lower level managers and staff, clients, and lay policy officials. Greater control by top managers is hypothesized to result from "management-oriented computing," defined here as improvement in the character of computer-based information flows (content, direction, speed, pattern of circulation) to top management. This is because management-oriented computing results in information which facilitates top management's ability to make and justify decisions, control lower level staff, reduce staff size and operating costs, speed-up work flows, and generally control day-to-day operational performance.

Management-oriented computing is viewed as the major determinant of power shifts which benefit management and accompany the introduction of computing in organizations. Management-oriented computing is expected to occur in organizations with top management characterized by an administrative reform ideology (Downs, 1967; Laudon, 1974). Realizing the potential of computing to serve their interests, these managers attempt to develop computing within their organizations. They become personally involved with computing and maintain control over computing decisions to insure that this technology serves their needs. In contrast, organizations with old-style political managers are less likely to see the potential of computing to serve their interests, be able to use it, or have the incentives to push for their information needs.[2] Therefore, they would be less likely to become involved with computing or to control computing decisions.

MANAGEMENT-ORIENTED COMPUTING

The concept of management-oriented computing requires clarification here because it differs from usual conceptions in

administrative literature. The concept refers to a particular conception of the kind of computer-based information utilized by top managers, and the degree that local government computing is oriented to providing top management with such information. There are various conceptions of top management's information needs and how automated information systems should be oriented to meet them (Kraemer, 1974).

The usual conception is that management information is different from operational information (Anthony, 1965; Daniel, 1961; Deardon, 1966), and therefore, computer-based management information systems (MIS) must be built separate from systems designed to serve departmental operations. This traditional conception stems from management theories which posit decision making and "problem solving" as the essence of managerial behavior and from management decision theorists who prescribe model building techniques as a means for solving management problems (Simon, 1957, 1960). From this perspective, management information is exemplified by the output of various planning or control models, e.g., a planning model which predicts the consequences of urban growth policies or a manpower allocation model which optimizes police beat assignments. The traditional MIS is the embodiment of such model operations and the information flows required to support the models in the organization's computerized systems (Ackoff, 1967).

A complementary alternative to the traditional MIS conception posits that much management information is formed from operational information by consolidating, sorting, listing, aggregating, or otherwise reorganizing the information for management uses. From this perspective, many management information needs might be met as by-products of automated departmental operations (Blumenthal, 1969). This formulation is supported by research that has found the process of "problem-finding" to be an important element of managerial behavior, and one largely overlooked by management theorists (Pounds, 1969). In this concept, much

management information is defined by extremely simple nonanalytical models, mainly involving comparisons across organizational or geographic areas, over different time periods, and over planned and actual achievements. And generally these models are supported by routine reports, exception reports, and ad hoc comparison reports produced in the daily operations of most organizations.

The traditional MIS conception may be irrelevant to understanding the current impacts of computing technology in local governments, and in other organizations, because the state of technical development (both the computing technology and its analytical applications) is primitive (Kraemer et al., 1975; Matthews et al., 1976). Furthermore, the behavior of decision makers suggests that they most often seek simple, unsophisticated information and analysis (Braybrooke and Lindblom, 1963; Lindblom, 1968; Wildavsky, 1964).

Our concept of management-oriented computing is based on this latter conception which appears more descriptive of MIS utilized by American local governments (Dutton and Kraemer, forthcoming). The automated provision of simple, frequent, and pervasive information is what we call management-oriented computing.[3] At one extreme, all computing applications can be oriented to serving the operating departments without generating information of direct value to top management. At another extreme nearly every automated application could serve the needs of operating departments and agencies, as well as generate information useful to top management. A high degree of management-oriented computing is expected to provide power payoffs for top managers because it means that a wide range of historical and other comparison information in the automated operational systems is available as a power resource for top managers.

PAYOFFS OF MANAGEMENT-ORIENTED COMPUTING

The literature on computer impacts suggests that greater top management control over the organization is a function of the

computer's impact on information for decision making, operational performance, and administrative control. Theorists predicted early on that computers would lead to improved management decisions (Leavitt and Whisler, 1958; Simon, 1960). While research indicates that computers improve the technical qualities of information (accuracy, timeliness, and availability) throughout organizations, much research suggests that the rather primitive computing in most organizations is likely to be irrelevant to top managers (Lucas, 1974) since much of it serves departmental operations (involving routine processing operations and record-keeping) rather than serving management decisions (involving analytical problem solving). However, we hypothesize that executives in governments with higher levels of management-oriented computing are more likely to perceive that computers have resulted in decision making benefits than are executives in governments with lower levels of management-oriented computing.

The early theorists also predicted that computers would directly affect operational tasks where computers are used (Leavitt and Whisler, 1958; Simon, 1960). Research tends to support these predictions although the impacts have usually been considerably less than predicted (Borodin and Gotlieb, 1972; Swart and Baldwin, 1971). Other research indicates that in addition to these impacts from direct use of computers in various tasks, computing might indirectly affect operational performance by providing top management with information useful to identifying inefficiencies, problems, and needs for resource allocations (Pounds, 1969). Thus we hypothesize that executives in governments with higher levels of management-oriented computing will perceive that computers have contributed more to improved operational performance than executives in governments with lower levels of management-oriented computing.

Computers were also expected to extend superiors' control over the decision processes and performance of subordinates

by quantifying more output information, making it readily available, and making it accessible directly by top managers without "filtering" by middle managers. Generally, the research indicates that computers result in greater control of superiors over subordinates at all levels of the organization, but particularly at the lower levels between supervisors and clerks (Mann and Williams, 1960; Whisler, 1970a, 1970b). Whether these impacts extend to the automated information systems of local government is unclear. We hypothesize that executives in governments with higher levels of management-oriented computing are more likely to perceive computers resulting in greater control of superiors over subordinates than executives in governments with lower levels of such computing.

PRECONDITIONS OF MANAGEMENT-ORIENTED COMPUTING

Several alternative explanations for the degree to which computing is oriented to serve management needs appear in the literature. These explanations focus upon technological development, the organizational environment, the values of organizational elites, and control of technology.

Technological development. The major thesis of the computing literature is that the value of an automated information system to an organization is dependent upon the developmental stage of computer technology (Nolan, 1973; Pendleton, 1971). This literature suggests the hypothesis that the payoffs of computing for top level management must await the development of a large scale, highly sophisticated computing operation. Computing should be technically developed to the stage that there exists a large number of automated applications within the organization and a sophisticated capability to integrate data gathered in day-to-day automated operations in order to generate management infor-

mation. Thus, management use of computing is likely to be greatest in those governments with the most advanced computer technology.

Organizational environment. A second explanation, based on research on technological innovation (Bingham, 1976; Row and Boise, 1974; Yin et al., 1976), suggests that local government decisions are primarily driven by demands and supports emanating from the organization's environment. The literature on computer innovation suggests that larger, growing, and higher status communities as well as those communities receiving outside funding seem to generate greater demands and supports for computing (Danziger and Dutton, 1977). Taken all together, the innovation literature suggests the hypothesis that demands and supports that drive government toward computer innovation might also be expected to drive it toward management-oriented computing—an innovative feature of information systems. We hypothesize therefore that management use of computing will be greater in those larger, growing, and higher status governments with outside support for computing.

In contrast to these two explanations based on the near technological determinism of the computing literature and the near environmental determinism of much of the technological innovation literature, our theoretical framework suggests that a third and fourth explanation—organizational values, and control of the technology—will be important determinants of computer utilization by management.

Values of organizational elites. The values, interests, and attitudes of top managers might determine their propensity to orient the organization's automated information systems to serve management needs. In particular, managers are expected to have a greater incentive to shape computing to serve their needs in those governments supportive of administrative

reform, and in those governments where the executive is supportive of computer technology.

The administrative reform movement stems from turn-of-the-century efforts to weaken the urban political machines and to take "politics" out of local government administration. The movement is characterized by structural reform (nonpartisan ballots, at-large elections, and council-manager forms of government), and the adoption of professional management practices. Modern reformers who support various structural reforms and professional management practices are expected to push computing toward a management orientation as a technological mechanism to reinforce these other mechanisms, or, as an alternative, to achieve the same reform goals of improving the efficiency and rationality of government operations (Downs, 1967; Laudon, 1974). Thus we hypothesize that management use of computing is greatest in those governments which have adopted reform structures and professional management practices.

Also, top management support for computing has been cited in research as a condition associated with the development of automated information systems that serve management needs (Powers, 1970; Swanson, 1972). Those managers with attitudes supportive of computers are more likely to take a personal interest in shaping the technology to serve their own interests. Therefore, we also hypothesize that management use of computing is greatest in those governments where top managers have more supportive attitudes toward computing.

Control of technology. Finally, our framework posits a relationship between the organizational control of computing and whose interests the technology serves. We expect the payoffs of computing for top management to be dependent on top management's ability to control computing decisions, particularly the design and implementation of automated

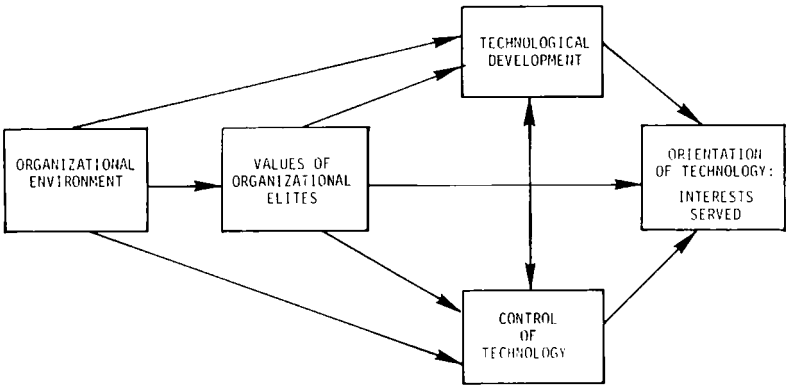


Figure 1: Theoretical Relationships Among Factors Affecting the Organizational Utilization of Technology

applications. Policies that might enhance management control of computing include: participation of top managers in decision making, less departmental user control of computer application design and implementation, and the centralization of computing hardware in a single unit under the chief executive rather than the decentralization of computing hardware within the operating departments using computers. More generally, we hypothesize that management use of computing will be greater in those governments where top management controls computing.

In summary, our theoretical expectations are broadly characterized by Figure 1. The orientation of a technology, and consequently the interests served by a technology, are likely to be determined by the values of those within the organization who control technological decisions as well as by the capabilities of the technology and by the demands and supports emanating from the organizational environment. More broadly, the utilization of technology is viewed as a continuing social and political process in which various organizational elites consciously decide how a technology

shall be used. The values of elites predispose the use of a technological innovation and thereby affect the technology's impact.[4]

Therefore we expect computing in local government to create payoffs to top management in the form of increased power in relation to other governmental actors when computing is oriented to serving management needs. Computing is likely to serve management needs in those local governments in which managers have exercised some control over the utilization of the technology. We expect management control of computing to be greater in local governments characterized by support for computer technology and administrative reform values. And management-oriented computing is likely to be greatest in governments where computer technology is most highly developed and the organizational environment is most supportive of technological innovation.

METHODS AND DATA

The research strategy of this study is to develop a measure of management-oriented computing—the degree to which computing is oriented to serving top management within the local government setting. In addition, we develop indicators of the perceived impacts of computing which are taken as the major dependent variables in an analysis of the payoffs of management-oriented computing. And we develop indicators of the four classes of independent variables (the technological development of computing, the organizational environment, the values of organizational elites, and the control of computing decisions) used to explain the degree of management-oriented computing in local governments.

This study is based upon three sources of data. The first is a pretested, nationwide census survey sent during the spring of 1975 to the 403 U.S. cities with populations of 50,000 or

more and to the 310 counties with populations of 100,000 or more. The survey consisted of three self-administered questionnaires: one was mailed to the appointed or elected chief executives (mayors, city managers, county executives, board chairmen, county administrators); another two were mailed to the manager of each data processing installation serving the city or county with the exception of private service bureaus. The survey obtained an 80% response rate for each questionnaire in municipalities and 70% in counties. The second data source used for the study is U.S. census data from cities and counties, and the third source is intensive field work in 40 U.S. cities conducted in 1976. The latter observational data is used to illustrate and clarify statistical findings.

A correlational and multivariate design is used to assess the degree of statistical association between survey data on the level of management-oriented computing and both its hypothesized payoffs and hypothesized preconditions. Municipal and county governments are combined for analysis because separate analysis indicated that the form of government (city/county) fails to specify or explain the observed relationships.[5] Thus, the combined analysis provides considerably greater parsimony to the analysis without a loss of information.

FINDINGS

Management-oriented computing is expected to provide power payoffs to top management and to be more prevalent in certain local government milieus. Previous sections have presented both a theoretical basis for these expectations and a series of specific hypotheses. The Appendix describes indicators which operationalize the hypotheses. Here we evaluate the hypotheses on the basis of statistical associations between management-oriented computing and its related impacts and preconditions. Once the major preconditions of management-

TABLE 1
Executive Perceptions about the Use of Computer Generated Information

Chief executives were asked:	Percentage Indicating: Never	Seldom	Occasionally	Often	Very Often	Total	(N)
EXECUTIVE USE							
How often do departments provide computer generated reports to you, the chief executive?	4	17	36	37	6	100	(509)
How often is computer generated information utilized by your staff to prepare reports?	2	12	30	42	14	100	(509)
LEGISLATIVE USE							
How often do departments present computer generated reports to the legislative body?	12	33	35	18	2	100	(503)

oriented computing are identified, multivariate analysis is used to examine the independent and combined effects of the various conditions which appear to promote management-oriented computing and its impacts. But, first we assess the degree to which top managers utilize computer-based information and we describe our measure of management-oriented computing.

LEVELS OF MANAGEMENT-ORIENTED COMPUTING

Given the unsophisticated nature of the management information systems in local governments, one would expect top management use of computer-based information to be low. However, the field work and our survey of U.S. cities and counties indicates that a large proportion of top managers use computer-generated information, either directly or indirectly. Table 1 shows that 43% of the executives indicate they receive computer-generated reports from the departments "often" or "very often." And, 56% of the executives indicate

that their staff uses computer-generated information to prepare reports "often" or "very often." However, as Downs (1967) implies, local legislators make less use of such reports and therefore are less likely to enjoy any benefits attendant to their use.

To operationalize our concept of management-oriented computing, we define "top management" to encompass only the chief executive official of the government and exclude legislators and departmental managers. Within this classification, top management is broadly defined to include professional executives such as city managers as well as elected executives such as mayors, given that many elected executives perform the top management role in cities and counties. Given this definition, we operationalize the extent of management-oriented computing within a local government as the degree to which top management utilizes computer-based information. Two questions (the first two items of Table 1) are combined to develop a general indicator of the degree of management-oriented computing (Appendix). This measure simultaneously taps management use of computing and the orientation of computing toward top management. It measures the mix of information supplied to or demanded, and used, by top management. Thus, it can be considered both an indicator of the degree of management-oriented computing and of management use. Governments scoring high on the index tend to have relatively more use of computing by top management.[6]

PAYOFFS OF MANAGEMENT-ORIENTED COMPUTING

The potential power shifts resulting from the use of computing depend on the degree to which computer-based information provides (1) better information for decision making, (2) information which can be used to affect operational performance, and (3) information about the activity of subordinates. To the degree that computing actually provides these benefits, we should find that chief executives perceive

TABLE 2
Correlations between Management-Oriented Computing and Hypothesized Impacts, with Controls for Chief Executive Support for Computing and for Governmental Computer Utilization

Indicators of Impact	Zero-Order Correlation r	(N)	Partial Controlling for Chief Executive Support r	(N)	Partial Controlling for Governmental Computing Utilization r	(N)
Decision Making	.35***	(510)	.24***	(482)	.36***	(388)
Operational Performance	.24***	(512)	.09*	(482)	.20***	(388)
Administrative Control	.24***	(486)	.15***	(432)	.19***	(388)

*$p < .05$
**$p < .01$
***$p < .001$

computers resulting in better information for decision making, improved operational performance, and greater administrative control.

Indicators of the perceived contribution of computing to these areas were developed from a series of agree-disagree questions asked chief executives (Appendix). In some respects, objective indicators would be more desirable than subjective perceptions, but such measures are not feasible in a broad scale survey nor are objective measures at one-point-in-time likely to be as sensitive to what are clearly subjective and comparative impacts—better information, improved performance, and greater control.

Given these indicators and our theoretical expectations, each indicator of computer impacts should be positively related to the degree of management-oriented computing. This is the case (Table 2). In governments with higher levels of management-oriented computing, executives tend to perceive computer impacts on decision making, operational performance, and administrative control.

An alternative explanation for executives' perceptions is that executives are predisposed to perceive higher impacts from computing because they are highly favorable about

technology and have committed themselves to computing through investment and other decisions. Table 2 shows that with controls for the level of chief executive support for computing (Appendix), the relationships between management-oriented computing and perceived impacts are reduced, but not eliminated. Even controlling for executive support, executives are more likely to perceive decision making and administrative control benefits where management-oriented computing is high. Only the executive's perception of computer impacts on operational performance appears to be explained by chief executive support.

A second alternative explanation is that greater governmental computer use, regardless of its orientation to management, results in better information for decision making, improved operational performance, and greater administrative control. In fact, an assumption of most literature on computer impacts is that computer use results in positive impacts. And, little attention is focused on how computing might have different impacts—positive for some and negative for others—depending on whose interests the technology is oriented to serve. If this alternative explanation is true, executives in those governments which have adopted computers earlier, have invested more in computing (both proportionately and on a per capita basis), have implemented more computer applications, and have developed a more sophisticated range of applications should perceive the greatest impacts on decision making, operational performance, and administrative control. Surprisingly, an index of governmental computer utilization which reflects these aspects of computer use is not related to *any* of the hypothesized impacts. Also, control for the level of governmental computer utilization has virtually no effect on the relationship between management-oriented computing and the hypothesized impacts (Table 2).

This examination of these alternative explanations for the executive's perceptions adds to the more general notion that

management-oriented computing enhances the control of top managers vis-à-vis lower level personnel by providing managers with greater access to information relevant to management decision making, including information relevant to controlling subordinates. It also appears that management-oriented computing enhances the control of executives vis-à-vis local legislators, since executives and their staffs receive computer generated information considerably more often than legislators (Table 1). This inference is supported by our extensive case studies which indicated that the simple information available to executives with management-oriented computing is useful to executives in justifying their decisions to legislators, to department heads, and to citizen-clients. Although the quality of that information may be low, frequently the managers' need for support information is satisfied if they can produce simple, quantified evidence of program need or program performance (Ouchi and Maguire, 1975; Edelman, 1971).

PRECONDITIONS OF MANAGEMENT-ORIENTED COMPUTING

While management use of computing is more common than expected, considerable variability exists among local governments in the degree of computer use by top management. For example, while computer-based information is provided to executives "often" or "very often" in 44% of the governments, it is provided "seldom" or "never" in at least 25% of them (Table 1). We think it is important, therefore, to examine whether there are systematic factors which account for the variation in utilization by top managers.

Here we treat management use of computing as the dependent variable and four classes of independent variables as predictors. The four classes of independent variables, which represent alternative streams of explanations for variations in management computing are: (1) technological development,

TABLE 3
Correlations between Management-Oriented Computing and Hypothesized Independent Variables

Categories and Indicators	r	(N)
I. TECHNOLOGICAL DEVELOPMENT		
COMPUTER TECHNOLOGY		
Operating system sophistication	.05	(346)
Total core capacity	-.02	(344)
Input-output sophistication	.02	(366)
COMPUTER APPLICATIONS		
Data file integration	-.02	(303)
Sophistication of applications	.11*	(403)
Number of operational application	.14**	(395)
II. ORGANIZATIONAL ENVIRONMENT		
Total population (Log_{10})	.11	(512)
Population growth	.08*	(505)
Socio-economic status scale	.08*	(503)
Presence of outside funding	.09*	(351)
III. VALUES OF ORGANIZATIONAL ELITES		
REFORM ORIENTATION		
Structural reform	.09*	(512)
Professional management practices	.16***	(504)
SUPPORT FOR COMPUTING		
Chief executive support	.33***	(512)
IV. CONTROL OF TECHNOLOGY		
CONTROL OF COMPUTING DECISIONS		
Top management control	.24***	(477)
User control of application design	-.11*	(320)
CONTROL OF COMPUTING RESOURCES		
Hardware decentralization	-.01	(401)
Independent computing unit under executive	.06	(403)

*$p < .05$
**$p < .01$
***$p < .001$

(2) the organizational environment, (3) the values of organizational elites, and (4) control of technology. The specific variables representing each class are listed in Table 3 and described in the Appendix.

The hypothesized preconditions of management-oriented computing are initially evaluated on the basis of the statistical association of the independent variables and the index of management-oriented computing (Table 3). While the corre-

TABLE 4
Multiple Correlations Between Selected Independent Variables and Management Oriented-Computing

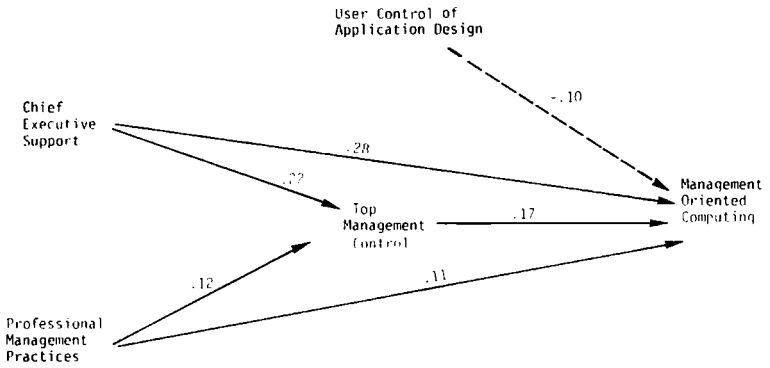
Independent variables[a]	Simple R	Cumulative Multiple R	Cumulative Multiple R^2	Increase in R^2
Chief executive support	.33	.33	.11	.11
Top management control	.24	.37	.14	.03
Professional management practices	.16	.39	.15	.01
User control of application design	-.11	.40	.16	.01

a. Variables were entered with independent regression coefficients at least twice their standard error.

lations identify variables which are associated with management use of computing, several important questions remain. To what degree is each variable independently associated with management use? What are the relationships among the independent variables related to management use of computing? And, how much of the variation across governments in management use is statistically associated with the entire set of independent variables? Answers to these questions are obtained by a step-wise regression analysis of the variables hypothesized to explain management-oriented computing. Table 4 displays the four variables which independently and cumulatively account for an important proportion of the variation in management-oriented computing.

Finally, we attempted to describe the interrelationship among these four explanatory variables through the exploratory use of path analysis. We have posited a model which relates those variables from Table 3 that our findings suggest to be most central to explaining degrees of management use of computing in cities and counties. Path analysis results are displayed in Figure 2.

The most significant finding to emerge is the generally weak association between management use of computing and each of the independent variables. Individually and collec-



a. "Path coefficients" displayed are standardized regression coefficients. Each arrow or path indicates a direct effect. All the direct path coefficients in bold lines are significant by the standard convention of being twice their standard error. Broken lines indicate negative coefficients. Arrows are deleted with coefficients less than that criterion.

Figure 2: Path Diagram of Independent Variables Associated with Management-Oriented Computing

tively, the theoretical explanations account for a small proportion of the variation in management use of computing. While the technological development of computing, top management values, and control over computing decisions have marginal impacts on the use of management information, these impacts seem to represent a braking or accelerating effect rather than preconditions for management-oriented computing. Yet some explanations appear relatively more important among these generally weak associations.

First, the values and attitudes of top managers appear to be the variables most significantly associated with management use of computing. Table 4 shows that top management support for computing is the most important predictor of management use, and Figure 2 shows that top management support both directly and indirectly relates to management control of computing decisions. Managers who are positive about computing tend to be in those governments with a greater use of computer-based information by top management.

In addition, a reform orientation is related to management use of computing. Local governments which have adopted professional management practices have greater management use of computer-based information. Cities, but not counties, which have adopted structural reforms also have greater levels of management-oriented computing (one of the few relationships specified by form of government).[7] Further, professional management practices are both directly and indirectly associated with use through top management control of computing expansion decisions (Figure 2).

Second, control over computing decisions, but not the control of computing resources, appears to be an important determinant of management-oriented computing. In particular, decision structures which give department users greater control over application design and development are more often present in governments with low levels of management computing whereas those structures which provide top managers greater control are more often present in governments with high levels of management computing. Table 3 shows that management use of computing is relatively higher where top managers have more control over computing expansion decisions and department users have less control over design decisions. But, neither hardware centralization nor the presence of an independent computer installation under top management, both measures of organizational structures likely to enhance top management control over computing resources, relate to greater management computing. In addition, Figure 2 shows that greater top management control of computing decisions tends to be more prevalent in governments with more professional management practices and greater chief executive support for computing.

Third, the sophistication of computing is not significant in explaining management use of computing. Table 3 shows that all indicators of sophistication are both weakly and inconsistently related to management use of computing. Surprisingly, there seems to be no appreciably greater management

use of computing in governments with higher levels of technological development.

Finally, the organization's external environment is not important in explaining management use of computing. While studies of computer innovation indicate that the adoption of computing and the extensiveness of automation relate to measures representing the social and economic environment, our findings suggest that how the technology is utilized and who it serves within the organization, is relatively independent of the organization's external environment. Table 3 shows that measures of the organizational environment are related to greater management use of computing in the expected direction, but each relationship is weak and no variable independently accounts for an important proportion of the variance in management-oriented computing (Table 4).

The weak associations of these independent variables and management computing tend to further endorse our concept of management-oriented computing. Computer-based management information does not appear dependent on large amounts of technical, monetary, or organizational resources being devoted to technological development in the form of sophisticated analytics or sophisticated government-wide integrated data bases. Thus, the use of computer-based information by top management is likely to be dependent more on the personal awareness, imagination, and predispositions of top managers and staff, the computing staff, or both. For example, an executive staff member who is aware of both top management's information needs and how currently automated applications can meet those needs, might alone be enough to reorient computing to providing top management with computer-based information.

SUMMARY AND DISCUSSION

This study has attempted to assess the power payoffs of computing in local governments and to identify the charac-

teristics of those governments where computing results in relatively greater shifts of power and control to top management. An index of management-oriented computing characterizes the extent to which computing is oriented toward serving the needs of top management for information. The examination has been organized in terms of theoretical predictions about the impacts of computing and in terms of alternative explanations for governmental variation in the levels of management-oriented computing.

The study has shown that management-oriented computing is associated with executives' perceptions that computers have had impacts that are beneficial to top management. These impacts are in the area of decision making and administrative control but not in operational performance. We have inferred that, where these impacts have occurred, they have occurred primarily as a result of improved information flows which facilitate the executive's ability to justify decisions, control lower level units, reduce staff size and operating costs, speed up work flows, and generally control day-to-day performance in the operating units. The study has also shown that chief executives and their staffs are greater beneficiaries of improved information flows than are legislators. We have inferred that, where these impacts have occurred, they have enhanced the executive's capability to demonstrate program need or performance to legislators and citizens. These findings and related inferences suggest that management-oriented computing leads to greater top management control vis-à-vis lower-level managers, staff, lay policy officials, and citizens. Thus, the power shift hypothesis is indirectly supported.

Of more general policy significance is the prospect that power shifts within organizations translate into policy shifts. To the degree that different organizational actors are advantaged by computer-based information systems, different interests might be served. A technology controlled by and oriented to top management might be expected to serve their goals,

such as greater efficiency, cost cutting, and centralized control of operations. However a technology controlled by and oriented to the operating departments might allow agency staff greater autonomy in exercising their professional judgments on how to best serve their clients.

The assessment of alternative explanations for management-oriented computing suggests that computer technology is more likely to serve the interests of top management in reform-oriented communities, where the executive is supportive of computers, where appointed executives tend to control computing decisions, and where departmental users have less control over design and implementation. Surprisingly, environments with extensive computer applications and highly sophisticated technology are not more likely to generate information for top management. Perhaps greater extensiveness and sophistication attenuate top management control because they increase the complexity of the task. Also, neither the formal structure of computing services nor the organizational environment appear to constrain or to promote management-oriented computing.

These findings suggest that the values of organizational elites and the relative control of elites over the technology drive the orientation of technology, and do so largely independent of the organizational environment or technological development of the government. The values of organizational elites appear to be the most significant determinants of management-oriented computing. The reform "ideology," which seems to be best captured by the adoption of professional management practices and support for computing, is a better overall explanation than reform structures. And the informal organizational control of computing, but not the formal organization of computing services, appears an important determinant of management-oriented computing. Structures which give operating department users control over application design and development are inversely associated with management-

oriented computing whereas those structures which provide central administrative control are positively associated.[8]

These classes of variables are suggestive of those that might apply to the utilization of other technologies in public organizations, especially in local governments. Hence, other studies of the utilization of technology in organizations might benefit by a focus on the values and interests which are likely to be served by a technology. Such a focus will be more likely to address technological utilization as a social and political process in which the orientation of a technology is shaped by the interests and values of those who control the technology.

More broadly, research should be sensitive to the distribution of the benefits and costs of any given technology. While many defenders of technology insist that technology is a neutral means to achieve an end (Mesthene, 1977), technology as implemented in particular organizational settings is rarely neutral in its impacts (Winner, 1977b). Given the way that various technologies are designed, supported, and used, they often cause shifts in the distribution of values and rewards among individuals, groups, or organizations. When this is the case, as it appears to be with computer technology, research must be sensitive to the politics of technological utilization—the interests, values, and relative control of organizational elites.

NOTES

1. Information is considered a basis of power in organizations similar to other resources such as wealth, legitimacy, formal position, and expertise. Therefore, access to information is likely to affect the differential bases of power among various organizational actors. Computerized information systems are important in that they affect access to information by changing the character of information flows including the direction, speed, pattern of circulation, or content (Lawler and Rhode, 1976; Oettinger, 1971; Westin, 1972).

2. The elected and appointed executives have an incentive to pursue objectives which enhance their career opportunities. While greater administrative control is

likely to be an objective of the professional manager whose ambitions depend on a sucessful management record, such control is not likely to be an objective of the elected executive whose ambitions are less dependent on a management record.

3. Numerous examples were cited during field visits with data processing managers regarding useful information for decision making that point to the value of simple information in defining problems, showing program need, or indicating program performance. A typical example was the identification of a salary equity problem with the discovery that police personnel dominated the top salary ranks of municipal employees. A simple listing of all employees ranked by yearly salarly (including fringe benefits) highlighted the problem. Also, see Edelman (1971), Ouchi and Maguire (1975), Lawler and Rhode (1976).

4. Hage and Dewar (1973) take this perspective. The influential role of elite values is also a major perspective in the study of organizational innovation and of the communication of innovation generally (Danziger and Dutton, 1977; Rogers and Rogers, 1976; Rogers and Shoemaker, 1971). Laudon's (1974) research on computerized urban information systems was the first study of computing to treat decision maker values as a major independent variable explaining the adoption, use, and impact of computer technology.

5. Those cases where relationships are specified by form of government are noted. While this analysis follows the pattern of many organizational studies which compare different kinds of organizations, it differs significantly from previous urban policy studies by considering both cities and counties. Counties are typically ignored by urban policy analyses for a variety of reasons including the belief that there exist systematic differences between cities and counties which make comparative analysis suspect. This study suggests that in regard to how computer technology is used, there are far more similarities than differences between cities and counties in the factors accounting for management-oriented computing and its related impacts. However, a related study of the factors accounting for computer innovation indicated sufficient variations in the findings to suggest that continued independent analysis of cities and counties is reasonable (Danziger and Dutton, 1977).

6. An alternative indicator of management-oriented computing would be based on the presence of computer applications which clearly serve top management. Such an indicator was rejected because our field studies show that management makes extensive use of applications not designed exclusively to serve top management.

7. Pearson correlations between structural reform and management-oriented computing range from .08 in counties to .17 in cities.

8. This assessment has policy significance in addition to its theoretical relevance. The use of computers and data processing among cities and counties in the United States is extensive and has been facilitated somewhat by federal financial support for local development efforts. Most recently, federal support has emphasized developing applications of computing oriented towards the needs of top management in local government on the assumption that better control would result. While this study indicates that management-oriented computer use leads to greater top management control in organizations, the study shows no relationship between this pattern of computer use and federal support. This might be expected since federal support

generally has been oriented primarily toward reporting systems designed to serve federal agency needs or toward operational systems designed to serve specific functional departments. Very little federal support has been provided for orienting either the reporting systems or the operational systems toward top management needs.

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APPENDIX
DESCRIPTIONS OF MEASURES

I. COMPUTER UTILIZATION

A. Management utilization of computing

1. Management-oriented computing. This index is based on the summation of the following two items: "How often do departments provide computer-generated reports to you, the chief executive?" and "How often is computer-generated information utilized by your staff to prepare reports?" Each item was coded: never (0), seldom (1), occasionally (2), often (3), very often (4). Index scores represent the average value of all non-missing responses.

B. Local government utilization of computing

1. Speed of adoption. Number of years (prior to 1975) that EDP services have been utilized by the government.

2. Level of commitment to computing. Total expenditures of all government computing installations as a percentage of total governmental expenditures in 1975.

3. Per capita investment in computers. Total expenditures of all government computing installations divided by total population.

4. Extensiveness of computing. Managers were presented a list of 258 kinds of computer applications to which they could provide additions. This scale equals the total number of computer applications which the data processing manager indicated to be operational.

5. Application sophistication. This index, which ranges from 0 to 4, is based on the number of four different types of "information processing tasks" within which at least two computer applications are operational. The tasks, in order of degree of sophistication, are: record-keeping, calculating/printing, sophisticated analytics, and process control. Broadly, each type of information processing task (IPT) requires more sophisticated data processing technology (particularly software) and the 0-4 scale of sophistication tends to approximate a cumulative scale pattern.

Measures of fit for the sophistication scale components, relative to an ideal cumulative pattern are: coefficient of reproducibility = .93; minimum marginal reproducibility = .76; coefficient of scalability = .71.

6. Governmental computer utilization scale. The overall utilitization scale is the sum of the standardized scores of each of the above five components (times ten and plus 50). For a more complete treatment of the components of this index, see Danziger and Dutton (1977).

C. Sophistication of computer technology

1. Operating system sophistication. Central processing units at each installation were classified as: glorified adding

machines (1); batch only (2); batch only, multiprogramming, no communication capability (3); the above plus on-line (4); on-line, multiprogramming, fixed task, possible spooling (5); on-line, multiprogramming with non-fixed memory allocation schemes (6); on-line, multiprogramming, variable task size (7). The index was given a weighted average in governments with more than one installation through weighting by total core capacity.

2. *Total core capacity.* Sum of total core capacity of all CPUs in all city or county EDP installations as measured by bytes.

3. *Input-output sophistication.* This is an additive index which sums the following: 1 point if card reader, keypunch or card punch is used; plus 2 points for magnetic ink character reader, optical character scanner, key-to-tape or key-to-disk; plus 1 point for plotter; plus 5 points for cathode ray tube terminal (CRT) or remote timesharing typewriter terminal, plus 1 point for a graphics terminal.

D. Sophistication of computer applications

1. *Data file integration.* This index is the standardized sum of the level of data base management technology which is scored as recognized DBMS use (4); homemade DBMS or recognized file management system used (3); no DBMS used (0); and the number of data files shared by two or more government departments.

2. *Sophistication of applications.* See IB5.

3. *Number of operational applications.* See IB4.

II. ORGANIZATIONAL ENVIRONMENT

A. Socioeconomic environment

1. Total population(log_{10}). 1970 U.S. Census estimates.

2. *Population growth.* Percent population change 1960-1970.

3. Socioeconomic status scale. As an indirect measure of community support, the socioeconomic status scale is the sum of the following standardized variables: percent employed in managerial and professional positions; percent of families with incomes of $25,000; median school years completed; and percent of persons 21 years of age and over who have completed four or more years of college.

B. External policy environment

1. Presence of outside funding. Received funding during 1974-75 for computing. Available figures of actual amounts received from outside sources were deemed too unreliable. The dummy variable includes federal or state sources, and includes the direct application of federal revenue-sharing monies.

III. VALUES OF ORGANIZATIONAL ELITES

A. Reform orientation

1. Structural reform. This index is scored as the degree local government reform structures have been adopted. The index is the average of the following three structures: the use of a chief administrative office, coded; city manager or county CAO (1); city CAO (.3); no chief administrative officer (0). Partisan

ballots coded: non-partisan ballot (1); only local parties (.3); partisan ballot (0). Electoral districts coded: all at-large (1); mixed (.5); all ward or district (0).

2. *Professional management practices.* This index indicates the proportion of government programs in which there are performance measures or written objectives. Chief executives were asked to respond with rough proportional estimates to the following: "Do departments and agencies within your local government establish written objectives for the programs and services they provide?" "Does the chief executive see measures of performance in meeting the objectives of these programs?" Coded: no explicit objectives (1); some programs have written objectives but few performance measures (3); nearly all programs have written objectives but few have performance measures (4); nearly all have written objectives and performance measures (5).

B. Support for computing

1. *Chief executive support.* This scale summates the standard scores of chief executives' responses to the following items, rated from strongly agree to strongly disagree: (1) "The computer is an essential tool in the day-to-day operations of this government"; (2) "In the future, the computer will become much more essential in the day-to-day operations of this government"; (3) "Computing and data processing have generally failed to live up to my original expectations" (reversed); (4) "In the future, a larger proportion of this local government's budget should support computers and data processing"; (5) "I have indicated to department heads that computers and data processing should be used wherever economically feasible in this government." The chief executive support scale is the summated score of each chief executive on each item such that high scores on the index represent high levels of support.

IV. CONTROL OF TECHNOLOGY

A. Control of computing decisions

1. Top Management Control. This index represents the number of the following criteria which were met: (1) Executive "strongly agrees" that, "Decisions about the expansion of data processing facilities and services are generally made by the chief executive, although others may initiate the request"; (2) In governments with an EDP policy board, recommendations of the board are made to the chief appointed official; (3) In governments with an EDP policy board, the chief executive's office is represented by the board; and (4) Executives believe it "extremely likely" that the chief appointed official and staff will have a major input in the decisions related to data processing, such as introducing computers to help perform a task. The number of criteria met were divided by the number of criteria applicable to that government.

2. User control of application design. The use control index indicates whether departments which use EDP services design and program their own applications. It is coded: 0 = users have not programmed or designed applications within the last two years, 1 = have programmed or designed applications, 2 = have both programmed and designed applications within the last two years. Responses were obtained from data processing managers.

B. Control of computing resources

1. Hardware decentralization. The number of in-house computer installations serving the government.

2. Independent computing unit under executive. Presence of an independent computing installation under the chief executive official.

V. COMPUTER IMPACTS

A. Perceived impacts

1. Decision making. This scale is the average summated score for executives' responses to: "In general, computers provide information which is helpful to me in making decisions"; "The computer makes information available to department heads that was not available before"; "Reports and other materials produced by the computer are too detailed for my use (reversed)." Each item was coded: strongly disagree (1) to strongly agree (5).

2. Operational performance. This scale is the average summated score for executives' responses to: "For the most part, computers have not reduced the cost of government operations where they have been applied"; "Computers usually enable a reduction in the staff necessary to perform a task." Each item was coded: strongly disagree (1) to strongly agree (5).

3. Administrative control. Executives' responses to: "Has the use of computers and data processing significantly altered the relationship between supervisors and staff in the departments which use them?" Coded: tends to give supervisors less control (1); no (2); and tended to give supervisors more control (3).

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